Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

2012-13 Annual Report to Parliament

The change you want to see

Canada

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19 June 2013

The Honourable Peter Van Loan, P.C., M.P.
Leader of the Government in the House of Commons
House of Commons
Ottawa, Ontario K1A 0A6

Dear Minister,

In accordance with subsection 13(3) of the *Canadian Transportation Accident Investigation and Safety Board Act*, the Board is pleased to submit, through you, its Annual Report to Parliament for the period 01 April 2012 to 31 March 2013.

Yours sincerely,

Original signed by

Wendy A. Tadros

Chair

"We need to find new ways to get our message out there, and work even harder to convince regulators and change agents to improve Canada's transportation system and reduce the number of accidents".

Wendy A. Tadros, Chair

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Message from the Chair

People say change comes whether you want it or not. But if you want a certain kind of change—real improvements that make things better, for everyone—those don't just stroll through the front door without an invite. You have to push for them.

At the Transportation Safety Board of Canada (TSB), it's our job to make sure that when something goes wrong—on our waterways, along our pipelines or railways, or in our skies—we find out what happened, and why, and we are clear about what needs to change so it doesn't happen again.

In other words, we're pushing for change every single day—the kind of change you want to see. It's a straightforward mandate, and the men and women who work at the TSB take great pride in the work we do. And because our work means so much to so many, we place extra emphasis on open communication: where gains have been made, we're happy to report it—but when not enough has been done, we'll say that, too.

This year, our Annual Report to Parliament again identifies a number of successes, including the 11 recommendations that have received our highest rating of Fully Satisfactory. Whether it's establishing protocols to make sure unsafe rail cars are repaired or removed from service, or requiring terrain awareness and warning systems on more private and commercial aircraft, those advances are outright wins—clear proof that Canada will be safer than it was just 12 months ago.

But as the updated edition of our safety Watchlist has also made clear, much work remains. That means we need to find new ways to get our message out there, and work even harder to convince regulators and change agents to help improve Canada's transportation system and reduce the number of accidents.

And that, really, is the ultimate bottom line: Canadians need to know that even as things change, a safer transportation system will remain the TSB's unchanging goal. Keeping their confidence and their trust—your trust—is why the TSB team goes to work every day. And it's why that work matters—to you, to us, and to everyone in this country.

Wendy A. Tadros
Chair

What we do

Mission

The TSB's mission is to conduct independent safety investigations and communicate risks in the transportation system, whether it's a grounded tanker, a ruptured pipeline, a derailed train or a downed aircraft.

Mandate

The *Canadian Transportation Accident Investigation and Safety Board Act* provides the legal framework that governs TSB activities. Our mandate is to advance transportation safety in the marine, pipeline, rail and air modes of transportation by

- conducting independent investigations, including public inquiries when necessary, into selected transportation occurrences in order to make findings as to their causes and contributing factors;
- identifying safety deficiencies, as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- reporting publicly on our investigations and on the findings in relation thereto.

As part of its ongoing investigations, the TSB also reviews developments in transportation safety and identifies safety risks that it believes government and the transportation industry should address to reduce injury and loss.

In making its findings as to the causes and contributing factors of a transportation occurrence, it is not the function of the Board to assign fault or determine civil or criminal liability. However, the Board does not refrain from fully reporting on the causes and contributing factors merely because fault or liability might be inferred from the Board's findings. No finding of the Board should be construed as assigning fault or determining civil or criminal liability. Findings of the Board are not binding on the parties to any legal, disciplinary, or other proceedings.

Independence

When an accident occurs, it's the TSB's role to find out what happened and why. Delivering these results for Canadians also means upholding their trust and confidence in the work that we do, which is why our organization must be objective, independent and free from any conflict of interest. By currently reporting to Parliament through the Leader of the Government in the House of Commons, the TSB remains separate from all other government departments and agencies. Our independence helps ensure we can arrive at impartial conclusions and make recommendations to those best placed to take action.

> **"Moving a recommendation to Fully Satisfactory is more than a phrase, it's a mission".**
>
> John Clarkson,
> TSB Board Member

Who we are

The TSB consists of approximately 220 employees located across the country. The Board itself is composed of up to five Board Members, including the Chair. Our headquarters is located in Gatineau, Quebec. We have a laboratory in Ottawa, Ontario, and regional offices in Vancouver, Edmonton, Calgary, Winnipeg, Toronto, Montréal, Quebec City, and Halifax.

TSB employees come with a wide range of background careers, including airline pilots, rail and pipeline experts, computer technicians, journalists, lawyers, engineers, fishermen, accountants, and members of the Canadian Forces, to name just a few. Whether they are painstakingly putting together the pieces of a shattered airliner, computer modeling the inside of a lifeboat locking mechanism, or overhauling a key database to better store and retrieve vital information, these men and women have spent over two decades making the TSB a world leader in transportation safety.

Our values

As federal public service employees, we are guided by the enduring public service values—respect for democracy, respect for people, integrity, stewardship and excellence. We, at the TSB, also place a particular emphasis on our own core values, which are of the utmost importance to the successful achievement of our mandate.

Excellence
We maintain a highly skilled and knowledgeable team of professionals through leadership, innovation and commitment to continuous improvement in the delivery of our products and services.

Openness
We actively promote the exchange of information to advance transportation safety.

Integrity
We are guided by honesty, impartiality, propriety and accountability for our actions and decisions.

Respect
We are committed to treating all individuals and organizations with consideration, courtesy, discretion and fairness.

Safety
We maintain and promote a positive and proactive safety culture.

Jacqueline Roy
Director, Communications

Marc-André Poisson
Director, Marine Investigations

Allen Harding
General Counsel

Jean L. Laporte
Chief Operating Officer

Mark Clitsome
Director, Air Investigations

Chantal Lemyre
Director General, Corporate Services

Leo Donati
Director, Operational Services

Kirby Jang
Director, Rail/ Pipeline Investigations

Leading the change

With the senior management team at the helm of our strategic direction, a number of important initiatives were undertaken in 2012-2013. In implementing its strategic plan, advancement in key areas were made towards maintaining a knowledgeable and professional workforce and information and data management.

We continued to enhance our capabilities to download and analyze data from a number of sources, including GPS units, avionics systems, and mobile devices. Great strides towards identifying information resources of business value are also paving the way to a new digital information environment. We bolstered our videoconferencing capabilities, streamlined human resources planning, and developed a 4-year corporate communications framework. As results from the Public Service Employee Survey were revealed, senior management addressed key areas for improvement and engaged employees throughout the process.

But above all, in a year when doing more with less drove most decision-making, senior management continued to deliver the quality investigations you have come to expect from the TSB.

"The TSB is one of the top places to work in the federal government. Our employees rate job satisfaction high, knowing the work they do is crucial to transportation safety in Canada and even around the world—and that it will be recognized."

2011 Public Service Employee Survey

Employee recognition

Even on a team of stars, some employees stand out just that little bit more. They're the ones who regularly go the extra mile—or two or three. In June 2012, at a ceremony marking National Public Service Week, the TSB was pleased to hand out five awards to the doers, the helpers, and the leaders who combine a wealth of experience with a real passion for their work.

TSB awards

Outstanding Achievement Award: This was shared by Ken Webster and Val Guertsman for their exceptional work on an investigation into the crash of a Sunrise Helicopters Bell 206 in 2011. Ken is a Regional Senior Investigator in the Air Branch, based out of the TSB's Richmond Hill office, and Val is a Senior Engineer Specialist at our Engineering Branch in Ottawa.

Excellence in Leadership Award: This was awarded to Susan Greene, Manager of MultiModal Training and Standards at head office in Gatineau. Susan was recognized for her excellent project management skills, and for consistently delivering items on time and within the allotted budget.

The Impact Award: This was presented to the IT Applications Development team. This group, which includes Juan Navarro, Nikolas Charlebois-Laprade, Line Laflèche, Pascal Simard, Pascal Sabourin and Marc Sirois, was recognized for the successful delivery of SharePoint 2010, the forecasting reports project, and the modernization of the rail and pipeline occurrence databases.

The Client Service Award: This was presented to Jamie Madden, Contracting and Procurement Specialist, in recognition of her exceptional efforts as a procurement and contracting specialist, where she regularly and demonstrably exceeded client expectations.

The Excellence in Investigation Award: This was presented to Paulo Ekkebus and Abigail Fyfe, senior investigators in the Marine Branch, as well as their supporting team for their work on the *Concordia*, a sail-training vessel that capsized off the coast of Brazil in 2010.

Queen Elizabeth II Diamond Jubilee Medal

In addition to our annual employee awards this year, a trio of TSB employees also received the Queen's Diamond Jubilee Medal, a special award given to Canadians who have made significant contributions and achievements.

Elaine Summers is a senior technical analyst at the TSB Engineering Branch in Ottawa. She was the second woman in Canada to obtain an Aircraft Maintenance Engineer license, and has been a role model and tireless advocate for young women, encouraging them to consider non-traditional careers.

John Britten is a senior air investigator at the TSB's head office in Gatineau. He has provided expert advice to countless national and international aviation accident investigations, and has also been a driving force behind many TSB safety communications—including those resulting from the Swissair Flight 111 and Cougar Flight 491 investigations.

Tom Griffith, recently retired, was a senior rail investigator at the TSB's Richmond Hill office. He has worked in the rail industry for 53 years and participated in hundreds of investigations, 28 of them as Investigator-in-Charge. His experience—and expertise—will be sorely missed.

"The work we do today helps to make Canada safer tomorrow".

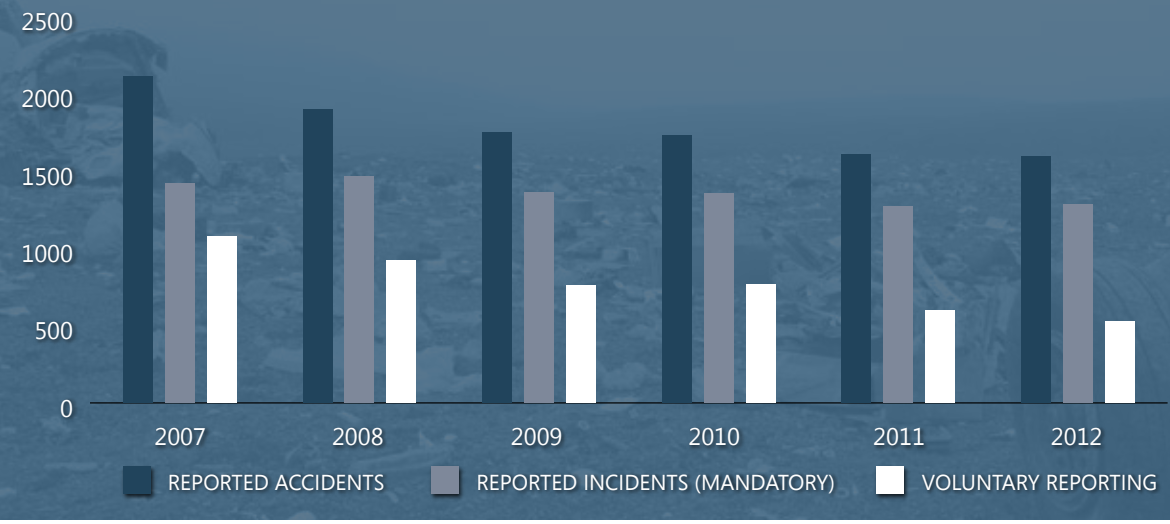
Ian S. MacKay,
TSB Board Member

The transportation safety landscape

TSB by the numbers

In 2012, a total of 1594 accidents and 1287 incidents were reported to the TSB.[1] The number of accidents in 2012 decreased by 1% from the 1610 accidents reported in 2011 and by 12% from the 2007-2011 annual average of 1819 accidents. The number of reported incidents increased by 1% from the 1269 reported in 2011, but decreased by 6% from the 2007–2011 average of 1373. In 2012, the TSB also received 525 voluntary reports.[2] Fatalities totalled 157 in 2012, up 3 from the 2011 total, but down from the 2007–2011 average of 161.

Figure 1: Reported occurrences



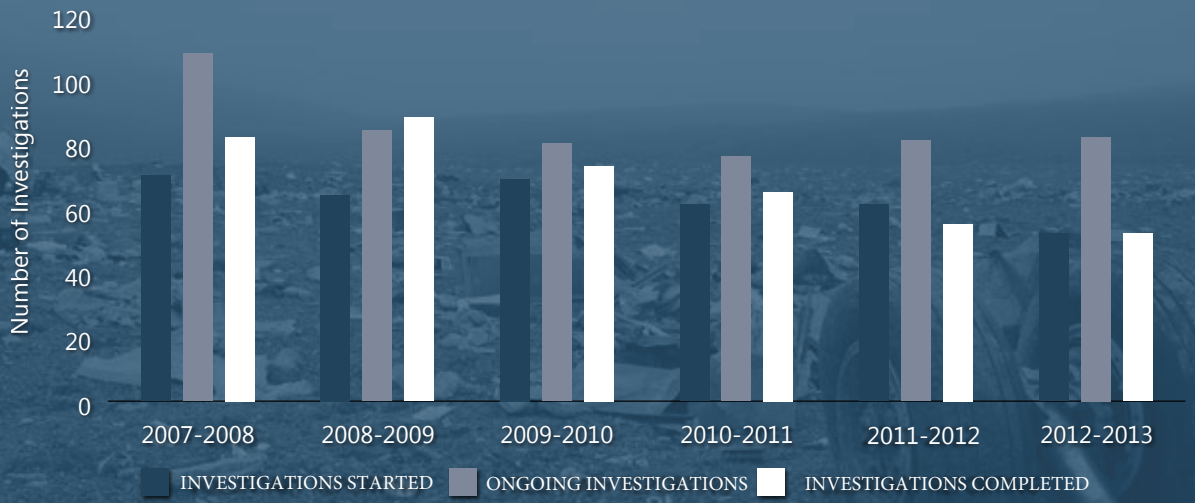
All reported occurrences were assessed under the Board's Occurrence Classification Policy to identify those with the greatest potential for advancing transportation safety. It is in these cases that a formal investigation is launched. However, whether we investigate or not, all information is entered into the TSB's database to keep records, analyze trends and validate safety issues.

[1] While the Board's operations are for the 2012–2013 fiscal year, occurrence statistics are for the 2012 calendar year unless otherwise indicated. Please note that, in a live database, the occurrence data are constantly being updated, causing statistics to change slightly over time. Comparisons are generally to the last 5 or 10 years.

[2] All occurrences reported to the TSB that are not required to be reported under the *Canadian Transportation Accident Investigation and Safety Board Act*.

In 2012-2013, 54 investigations were launched, and another 52 were completed, down slightly from the 55 completed in the previous year. [3] The number of ongoing investigations increased to 82 at the end of the year from 81 at the onset, and it took an average of 501 days to complete an investigation in 2012-2013, a decrease from the previous five-year average of 516 days.

Figure 2: Investigations



Overall, the TSB has been very successful in identifying safety issues and reducing risks in the transportation system. Each investigation led to a comprehensive report, identifying critical safety issues and contributing factors, communicating lessons learned and, when necessary, making recommendations aimed at reducing risks. Through the Occurrence Classification Policy and investigation methodology, our systematic approach ensured TSB resources were invested in areas with the greatest safety payoffs.

In 2012-2013, in addition to investigation reports, the TSB issued a total of 44 safety communications, [4] including 2 recommendations, 14 safety advisories, 24 safety information letters and 3 safety concerns.

Table 1: Safety communications

Sector	Recommendations	Safety advisories	Safety information letters	Safety concerns
Marine	0	5	6	0
Pipeline	0	0	2	0
Rail	0	4	14	2
Aviation	2	5	2	1
TOTAL	**2**	**14**	**24**	**3**

[3] Investigations are considered complete after the final report has been published. See Appendix A for a list of reports released in 2012-2013.

[4] See Appendix B or the definition of each of the TSB's safety communications.

When the TSB identifies safety issues, it doesn't wait until the end of an investigation to alert industry and government. Safety information is also provided informally to stakeholders throughout the investigation process, allowing them to take immediate action—a common practice for industry and government. Discussions with TSB investigators can also lead operators to take important safety measures before a report is released, such as the clearing of sightlines at a railway crossing by trimming bushes and vegetation.

Regulators, such as Transport Canada (TC) and the U.S. Federal Aviation Administration, regularly issue mandatory directives requiring inspections and replacements based on the TSB's preliminary findings. In these situations, the TSB reports on the corrective actions already taken by industry and government. When an investigation identifies a serious or systemic safety issue, the Board will issue a recommendation, which warrants the highest levels of regulatory attention.

Under the *Canadian Transportation Accident Investigation and Safety Board Act*, a federal minister who is notified of a TSB recommendation must, within 90 days, advise the Board in writing of any action taken or proposed to be taken, or of the reasons for not taking action. The Board considers each response, assessing the extent to which the safety deficiency was addressed. The TSB continues to publish its yearly assessment of industry and government responses to its recommendations.

Since 1990, the Board has reviewed the responses to a total of 547 recommendations.

Table 2: Board assessments of responses to recommendations, 1990–2013

	Marine	Pipeline	Rail	Air	Recommendations	%
Number of recommendations	147	20	131	249	547	100
Fully Satisfactory	119	20	118	150	407	74
Satisfactory Intent	18	0	6	21	45	8
Satisfactory in Part	8	0	7	59	74	14
Unsatisfactory	2	0	0	14	16	3
Unable to Assess	0	0	0	5	5	1

Since the TSB's inception in 1990, the vast majority of our recommendations have led to positive change. As of 31 March 2013, 74% of the Board's recommendations achieved Fully Satisfactory status. Another 8% were assessed as Satisfactory Intent, indicating change agents have taken action or plan to take action that will substantially reduce the safety deficiency.

In 14% of cases, a rating of Satisfactory in Part was assessed, which is when change agents have taken or plan to take action that will only partially address the deficiency. The remaining 3% of cases received a rating of Unsatisfactory, as change agents have not taken nor plan to take action that will address the deficiency. The Board has been unable to assess the responses to 5 recommendations.

To continue to raise the bar on safety, the Board is aiming for 80% of its recommendations to become Fully Satisfactory by March 2017. While some positive change has taken place, the Board remains concerned that not enough has been done to address outstanding safety issues, most alarmingly in aviation.

Figure 3: Ratings of assessed responses, 1990–2013

Communicating transportation safety

"Hats off to your openness on Twitter. The TSB's communications strategy has always been commendable, and is even more so now."

Maxime Landry, Journalist, TVA Nouvelles

Changing the way we communicate directly with Canadians

Sometimes it seems as if the world is moving faster than ever. Everything is connected, almost everyone's online, and the demand for information is constant and immediate. Facts, photos, updates and conclusions from investigations—people want it all, as soon as it exists, and sometimes even sooner. That means the old ways of responding have had to change—*we've* had to change. Part of our job at the TSB is investigating accidents, but so too is communicating what we learn to the Canadian public, and to the organizations and individuals best placed to make a difference. We're now communicating directly with Canadians rather than relying on mainstream media to deliver our message.

Over the past year that change has been significant: we joined Twitter last April, and within days we had a stream of followers that has grown steadily. We also began posting investigation photos on Flickr, many of which have drawn huge interest from the public and members of the media. Then we added a blog, increased our offerings on YouTube, and linked it all together with a brand new website designed to be more accessible, searchable, and user friendly than anything we'd had before. We're not just communicating when we release our reports—we're telling the story from the beginning of an accident.

We also decided it was time to update one of our most successful tools from two years ago: the TSB Watchlist. We added new issues, and removed others where progress was significant. Then, to help communicate just how important we view all of this, we created videos for every issue, posted them online, and made sure to distribute copies to all our stakeholders—spreading the word in a way that frankly hadn't been done before.

It's been a bold shift, and we did it for one simple reason: because that's what Canadians want.

That doesn't mean we've abandoned the tried-and-true. In 2012-2013, the TSB released 51 reports on investigations in the marine, pipeline, rail and air sectors. We issued 62 news releases and responded to well over 400 media inquiries in our headquarters (a figure, by the way, that doesn't include the thousands of questions that get handled at a regional level, or face-to-face at an accident site). On top of all this, we held 9 media events that generated almost 159 news stories across the country.

And then there's our outreach program, which has been revamped to better promote awareness of the TSB and key safety issues. In 2012-2013, our investigators, managers and Board members attended over 150 separate events, meeting with everyone from first responders, to regulators, to safety organizations, to members of the public. We sat in on board meetings, presented at conferences, and even visited high school classrooms—all to better spread the word about who we are, what we do, and what kinds of safety action are needed to make Canada's transportation system safer.

That's a lot of change, and we're not done yet. As we move forward into another year, much work remains. We're implementing a four-year strategic communications framework along with a three-year outreach strategy. Our mandate is to advance transportation safety, and that means we'll be conducting more investigations, using more expert analysis, and doing even more to make sure the lessons we learn are shared: with lawmakers, with industry, and with the people we're ultimately accountable to: the Canadian public.

New issues mean a new Watchlist

Two years ago, the TSB launched its first safety Watchlist. That list, which identified the most critical safety issues facing Canada's transportation system, became our blueprint for change. Here are the priorities—priorities based on two decades of experience, hundreds of accident investigations, tens of thousands of hours of research, and 41 very specific Board recommendations.

Well, TC and the transportation industry listened—and then they acted. Within months, over one-third of those 41 Watchlist recommendations had received our highest rating of Fully Satisfactory.

That's why, in 2012, we announced a new version of the Watchlist, one with items removed, but also one with updated issues, including several new challenges that need to be tackled. In drawing up this new Watchlist, we asked ourselves two key questions. First, on issues where there was change, was it *enough*—that is, had the risk been eliminated, or at least substantially reduced? And second, were there any new issues that deserved the attention of industry and Canadians?

For instance, Canada's freight railways have reduced the dangerous in-train forces that can destabilize today's ever-longer and ever-heavier trains. Measures such as distributed power, new marshalling and handling guidelines, and advanced computer programs mean Canadian railways are safer than they were two years ago.

Second, both TC and the ferry industry have put in place positive measures to ensure crews will be prepared for an emergency. New regulations will improve passenger counts and require crews to carry out more realistic emergency drills.

For both these issues, progress has been significant enough that we were able to remove them from the new Watchlist.

And that's not all, in the last two years, we have also seen positive action with respect to safety management systems on Canada's railways, as well as some movement on improved data recorders in the air, rail, and marine modes.

But our work is far from complete. Because the TSB's mandate is to advance transportation safety, and since transportation is always evolving, so are the risks.

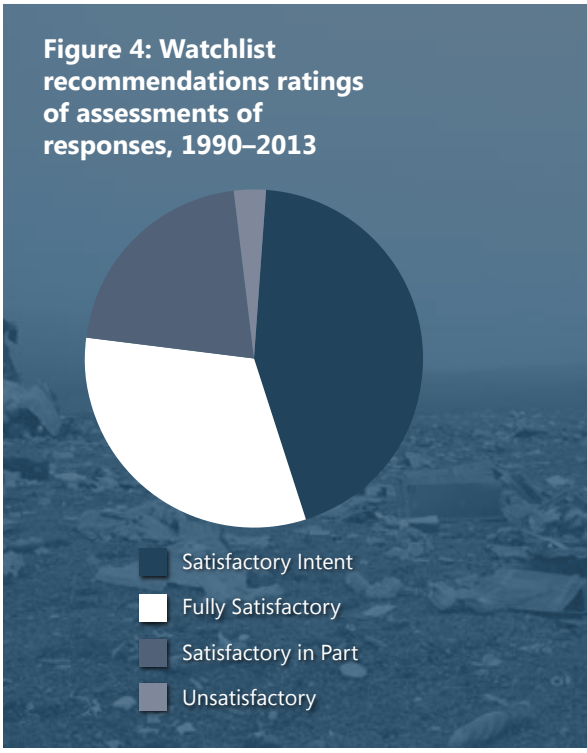
For example, early in 2012, a VIA Rail train derailed outside Burlington, Ontario, killing three crew members and leaving dozens injured. Thanks to the data recorder that was on board, our investigators were immediately able to begin piecing together some of what happened. But what was missing, because trains aren't required to have them, are voice or video recordings of crew communications inside the cab. Those are what we need to understand the full context in which decisions were made, and it's why we included this issue on the new Watchlist.

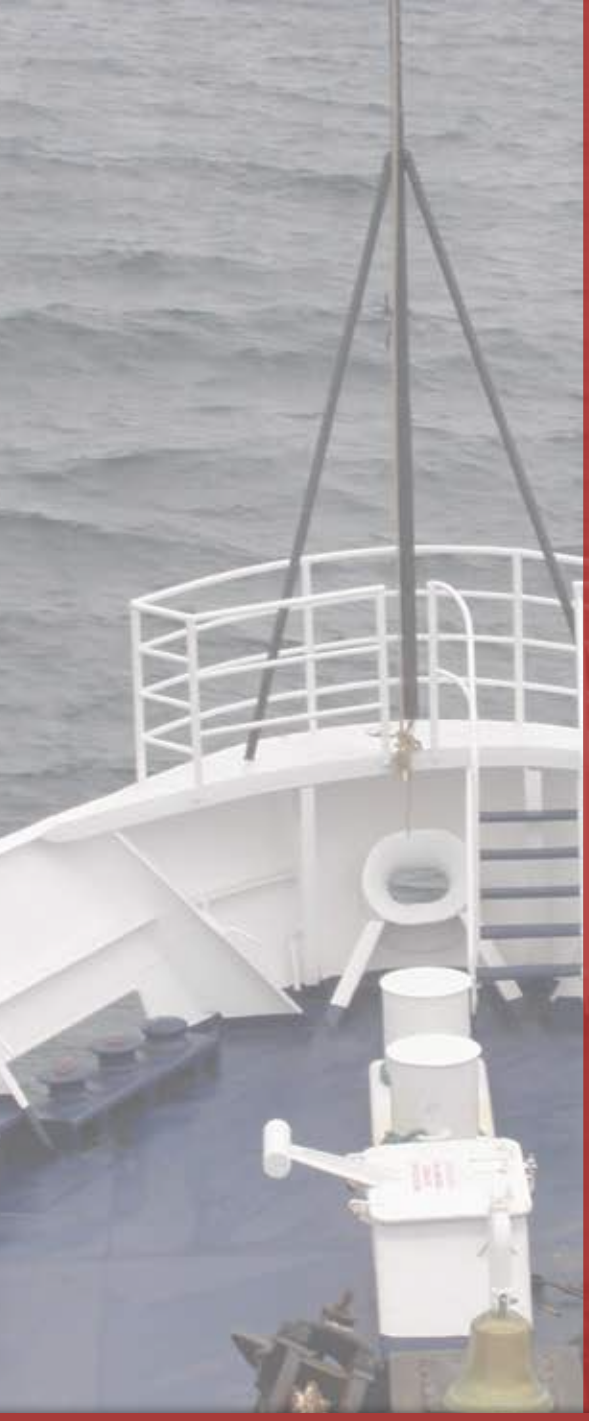
The second new issue has to do with railway signals, specifically, the manner in which they are misidentified, misinterpreted, or not recognized in time. Since 2002, there have been an average of 11 such occurrences per year—a troubling pattern that represents a significant risk to the public and environment when it results in a derailment or collision. That's why we want to see more safety defences put in place, to ensure that signal indications are consistently recognized and followed by locomotive crews.

Unfortunately, the Watchlist also contains issues where Canadians haven't seen the kind of change they deserve, and where in fact there has been little or no advancement since 2010. These include the issue of runway overruns at Canadian airports, and passenger trains that continue to collide with vehicles in our busy rail corridor. These and several other problems remain on the Watchlist because we still have a long way to go.

Looking ahead, we want to see a more concerted effort from TC and from our marine, rail, and aviation industries. We'll monitor what happens, too, making the results public so that all Canadians can see progress when it's made—and when it isn't. Hopefully, we'll be able to remove more items from the next Watchlist. It won't be easy of course, but it will make Canada safer. And that is our ultimate goal.

Figure 4: Watchlist recommendations ratings of assessments of responses, 1990–2013





Marine

In 2012-2013, encouraging progress was made in the marine sector as five Watchlist-related recommendations became Fully Satisfactory.

Loss of life on fishing vessels
A large-scale Safety Issues Investigation (SII) kept fishing safety top of mind for many within the fishing community. From discussions with fishermen to a national outreach campaign, the TSB kept the lines of communications open, pushing for key improvements. These efforts helped take stock of initiatives undertaken in response to the SII and encouraged the fishing community as a whole to develop a strong safety culture.

Fishing-related fatalities were, in fact, at an all-time low in 2012, and industry leaders reported a growing intolerance for fishing-related fatalities. As mariners gain a better understanding of the risks at hand, safety is better integrated into all fishing operations.

In 2003, the Board recommended that government and industry establish a safety culture within the fishing industry (M03-02). With such positive movement, this recommendation has now received the Board's highest rating of Fully Satisfactory. Further, new *Fishing Vessel Safety Regulations* have been drafted by TC and, once implemented, are expected to directly address other TSB recommendations regarding survival suits, the stowage and launching of life rafts, and vessel stability.

Marine safety management systems
Marine safety management systems (SMS) continue to be a top priority for the TSB. When the Watchlist was updated in June 2012, the TSB again called upon TC to require all commercial vessels to adopt an SMS and, further, that it be audited and certified. Unfortunately, TC has recently indicated that it will not heed the TSB's recommendation, leaving vessels under 24m and those carrying fewer than 12 passengers at risk. Until all small passenger vessels and commercial vessels operating in Canadian waters benefit from these critical safety defenses, the TSB will continue to push for concrete action.

"It's great to see how much progress we've made in the last 10 years on SMS, but as you point out in [your] video, much remains to be done."

Marc Grégoire, Commissioner, Canadian Coast Guard

Rail

Safety in the rail sector continued to see notable improvements in 2012-2013. With another four recommendations completely addressed, 90% of those issued since 1991 have now been assessed as Fully Satisfactory.

Thanks to the Watchlist, the most pressing rail issues have been brought to the forefront, and positive changes are being made to improve the safety of the Canadian railway system. The introduction of crashworthy memory modules, for example, has helped investigators access vital data after an accident. Improved train marshalling practices and increased oversight of safety management systems have also contributed to safer railway operations.

On-board video and voice recorders
To accurately piece together the sequence of events leading to an accident, investigators need to understand how the crew communicated and what actions took place in the cab. The way to capture this information is through on-board video and voice recorders, but industry is not required to install them. As a result of our continued call to action, TC tasked the Advisory Council on Railway Safety to study the issue, and its report is now being considered by the Minister.

Following signal indications
If signals are not consistently recognized and followed, there is a serious risk of collision or derailment. TC and the railways are exploring the potential for current locomotive fleet computer systems to include signal recognition and air brake control capabilities. However, there has been no formal strategy developed to adapt either emerging technology or existing on-board computer systems to provide fail-safe physical train control defences.

Passenger trains colliding with vehicles
About every two weeks, a passenger train collides with a vehicle at a public railway crossing, which is why this issue remains of great concern to the Board. In 2012-2013, TC, in collaboration with Operation Lifesaver, developed tools aimed at educating the trucking industry about crossing safety. TC also approved a new standard for warning systems at private and farm crossings, in addition to improving grade crossings on Canada's high speed passenger corridor. While these are encouraging initiatives, much work still remains to reduce passenger train-vehicle collisions.

"Our responsibility is to ensure our safety messages reach the right people: fishermen, pilots, locomotive and pipeline engineers".

Joseph Hincke, TSB Board Member

Aviation

In aviation, very limited progress has been made this year, and only one Watchlist-related recommendation (A95-10) has become Fully Satisfactory, leaving 7 others with significant room for improvement. In addition, 2 recommendations (A07-02 and A07-04) stemming from the investigation into the 2005 Air France accident in Toronto were changed from active to dormant as France's Direction générale de l'Aviation civile closed the files and indicated it would not take any further action.

Collisions with land and water
A collision with land and water is what happens when an otherwise sound aircraft, under pilot control, is unintentionally flown into the ground, a mountain, water or an obstacle. Referred to by industry as a "controlled flight into terrain", these collisions represented just 5% of aviation accidents, but almost 25% of all fatalities in 2009. In 2012-2013, TC published new regulations requiring many more private and commercial aircraft to be equipped with technology that warns pilots if they come too close to the ground. This change, once fully implemented, will address a long-standing recommendation, significantly reducing the safety deficiency identified by the Board in 1995 (A95-10).

Safety management systems
Since 2005, large air carriers in Canada have been required to have safety management systems. This requirement doesn't, however, extend to smaller carriers, such as air taxis, helicopter operators, commuter airlines and flight training schools, which are responsible for 94% of all air accidents and 95% of all fatalities. The Board is therefore concerned that, in the absence of TC requirements, these smaller operators, passengers and aircraft are placed at unnecessary risk.

Risk of collisions on runways
The TSB has long been concerned about the risk of collisions on runways, which industry often refers to as an incursion. In fact, since this issue was first placed on the Watchlist, the numbers have not come down; in 2010 there were 351 incursions, in 2011, there were 446, and in 2012, another 433. Despite the Board's heightened concern, TC has done little to encourage airports to improve procedures and adopt enhanced collision warning systems, which would considerably reduce the risk of collisions.

Landing accidents and runway overruns
To ensure passengers and crews arrive safely, pilots carefully calculate a number of variables, including the distance needed to land. Without accurate and up-to-date information, they run the risk of overshooting the runway. Over the last five years in Canada, this happened roughly once a month. Through countless investigations, the TSB has highlighted the need for improved runway surface condition reporting and back-up defenses designed to stop aircraft from overrunning the runway. As Canada now lags behind international standards, the TSB will continue to call upon TC and airports to better prevent landing accidents and runway overruns.

"It's not enough to identify a safety deficiency. You have to be committed to change".

Kathy Fox, TSB Board Member

Marine

Making safety a priority
from coast to coast to coast

Marine sector

Annual statistics

In all, 286 marine accidents were reported to the TSB in 2012, a 12% decrease from the 2011 total of 326 and a 27% decrease from the 2007–2011 average of 391. There were 12 marine fatalities in 2012, down from the 2011 total of 16 and the 2007–2011 average of 19.

Shipping accidents, which comprised 83% of marine accidents in 2012, were at a 38-year low, down to 236 from 287 in 2011 and from the five-year average of 337. A total of 37% of all vessels involved in shipping accidents were fishing vessels. There were 50 accidents involving people aboard ships, which include falls, electrocution, and other types of injuries requiring hospitalization. This number increased from 39 in 2011, but decreased from the 2007–2011 average of 54 accidents.

In 2012, shipping accidents resulted in 4 fatalities, comparable to 3 in 2011 but down from the five-year average of 9. Accidents aboard ship resulted in 8 fatalities, down from the 13 in 2011 and the five-year average of 10.

In all, 24 vessels involved in reportable accidents were reported lost in 2012, up from the 2011 total of 22, but down from the five-year average of 28.

In 2012, 274 marine incidents were reported to the TSB in accordance with mandatory reporting requirements, which represents a 24% increase from the 2011 total of 221, and a 11% increase from the five-year average of 248.

Figure 5: Marine occurrences

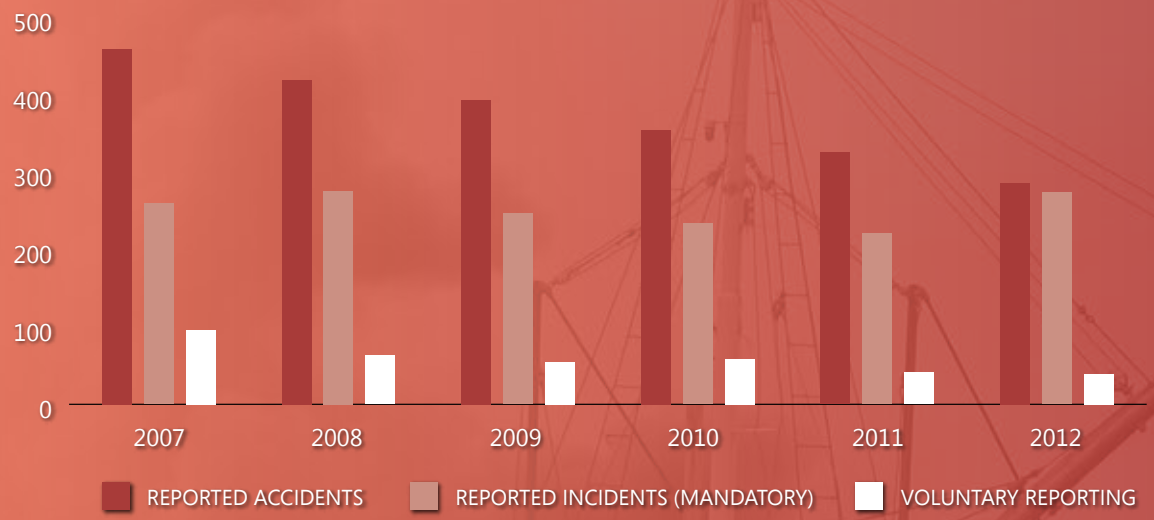
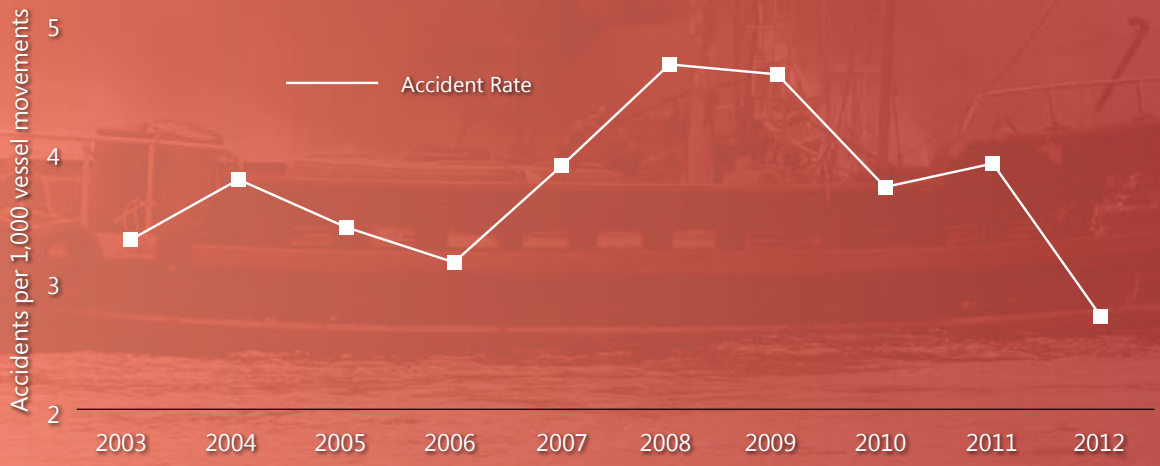


Figure 6: Canadian-flag shipping accident rates



Vessel movements are estimated for 2012 (Source: Transport Canada)

Investigations

In 2012-2013, 12 marine investigations were started and 10 were completed, a slight increase from 2011-2012. On average, investigations were completed within 522 days, up slightly from the 20112012 average of 504. Although well below the previous five year average of 660 days, this increase was due to a Canada-wide fishing safety study that spanned 1,086 days. Without taking this study into account, investigations were completed within 460 days on average.

Table 3: Marine Branch at a glance

	2007–2008	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Investigations started	7	6	12	6	9	12
Investigations completed	19	18	9	8	7	10
Average number of days to complete investigations	937	797	530	530	504	522
Recommendations	3	2	1	0	2	0
Safety advisories	12	7	7	5	8	5
Safety information letters	4	12	9	6	6	6

Recommendations and progress

No marine safety recommendations were issued in 2012-2013. However, the Board reassessed responses to 16 recommendations issued since 1990. Overall, safety has improved in the marine sector. Positive action has been taken on five Watchlist-related recommendations as these have been reassessed as Fully Satisfactory. Three of these Watchlist recommendations are related to fishing vessel safety, one is related to life raft accommodations, and one to safety management systems.

However, a key Watchlist issue that remains unaddressed is the introduction of safety management systems for commercial operators of small passenger vessels. This recommendation (M04-01), dating back to 2004, is the only marine recommendation whose status remains Unsatisfactory. Of the 16 active marine recommendations, 5 have become Fully Satisfactory, 8 are Satisfactory Intent; 2 are Satisfactory in Part; and 1 is Unsatisfactory.

While this represents an overall improvement from last year with 5 recommendations becoming Fully Satisfactory and 1 recommendation being upgraded from Satisfactory in Part to Satisfactory Intent, 2 recommendations have actually been downgraded. Recommendation M04-01 has been downgraded from Satisfactory in Part to Unsatisfactory and Recommendation M08-04 has been downgraded from Satisfactory Intent to Satisfactory in Part.

"In an unprecedented way, the SII has created the connective tissue to link prevention with accident investigation."

Gina McKay, Program Manager, Fish SAFE BC

Marine highlights

Moving the bar on fishing safety

In 2009, the TSB launched a comprehensive, three-year study on fishing safety in Canada. The goal was to find out why the same kinds of accidents kept happening, and what could be done to make commercial fishing safer.

Our investigators met with many stakeholders—vessel owners, fishing and safety associations, government bodies, trainers, unions and fishermen—and uncovered ten key issues affecting fishing safety in Canada. They also discovered a complex relationship between each of the issues, which affect the others in different ways. We came to understand that any viable solution would need to take this into consideration.

Our final report, released this year, became a catalyst for a national dialogue on safety. Because of the potential for change, and the importance of the lessons learned, we carried this conversation into communities across Canada.

We collaborated with safety associations and provincial agencies to produce a video on fishing safety, and distributed an action booklet in English, French and Vietnamese to hundreds of fisherman. We brought our message directly to the source—the men and women who dedicate their lives to the sea—to encourage them to take safety into their own hands.

The study was so well received that, in February 2012, the Quebec Standing Committee on Fishing Vessel Safety held its inaugural symposium focused on the TSB's ten key fishing safety issues. On the west coast, Fish SAFE, in collaboration with the Pacific Prawn Fishermen's Association, developed a list of prawn fishery best practices aimed at addressing unsafe work practices that put fishermen, crews and vessels at unnecessary risk. With the encouraging progress made in 2012-2013, our hope is that this investigation continues to foster a culture that makes safety a top priority from coast to coast to coast.

Better training and communication for mariners

Two investigations completed during the past year have paid significant dividends for the Canadian marine community. In December 2011, the bulk carrier *Orsula* was proceeding down the St. Lawrence River when it suddenly lost steering control and ran aground. Our investigation (M11L0160) revealed that behind the grounding was a lack of training; crew members were inadequately prepared to use backup steering controls in the event of an emergency.

Our investigators also visited eight other vessels and discovered that the problem was more widespread than we originally thought. As with the *Orsula,* crew members were generally unfamiliar with backup steering systems, placing the vessel and those on board at risk. The Board issued a call to action, advocating for improved training and familiarity with critical safety systems—and industry responded.

Following the accident, *Orsula*'s owner instructed all vessels in its fleet to perform weekly emergency steering drills. Crew members were not only to receive training on backup steering controls, but also had to demonstrate the technique to the master, helping ensure everyone onboard is better prepared for emergencies.

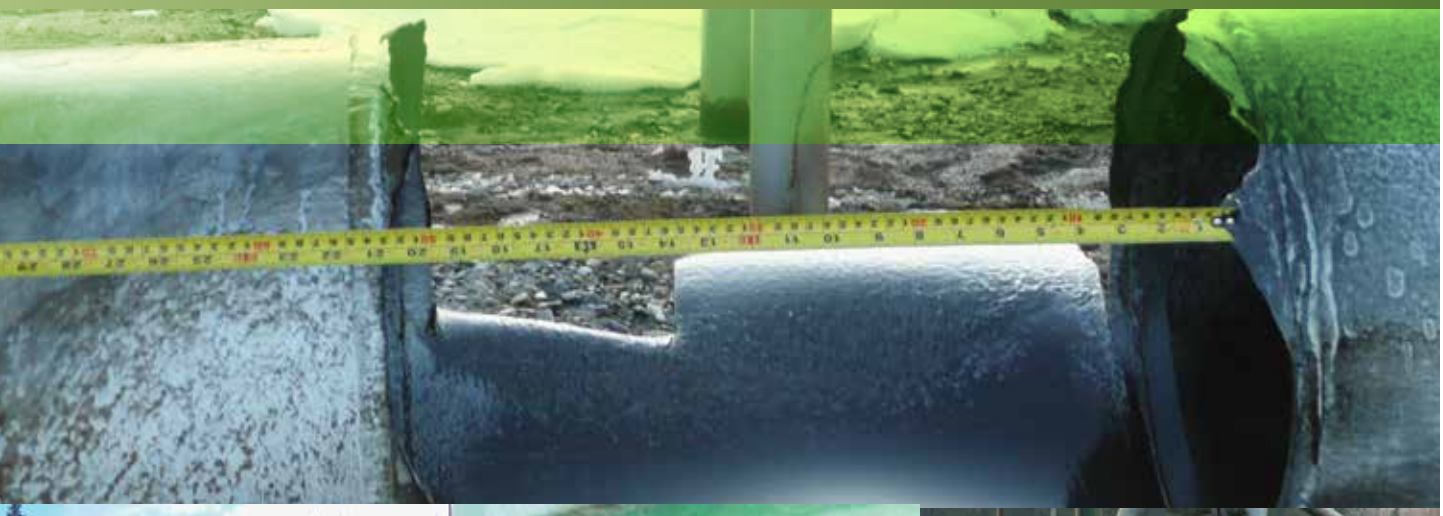
In a separate occurrence a year earlier, the passenger vessel *Clipper Adventurer* ran aground on a shoal off the coast of Nunavut. The Arctic waters in this area are mainly uncharted, and the shoal wasn't marked on any navigational charts. Our investigation (M10H0006) revealed that the shoal had been discovered by a Canadian Coast Guard (CCG) vessel a few years prior, but the *Clipper Adventurer* was never advised and remained unaware of its existence.

The Canadian Arctic region is quite remote and not easily accessible by search and rescue or pollution response teams. Because accidents, such as this grounding, can have far reaching impacts—injuries, loss of life and damage to the fragile northern environment—the Board met with the CCG to express their concern. As a result, the CCG committed to providing all vessels entering into Arctic waters with crucial safety information. As of 2013, the Canadian Hydrographic Service will update navigational charts for this region as navigational hazards, such as shoals, are reported. An Artic Voyage Planning Guide has also since been developed to provide mariners travelling in the Arctic region with a comprehensive digital planning tool.

Pipeline

Contributing to a safety record of zero fatalities in operations on federally-regulated pipelines for nearly a quarter century

Pipeline sector



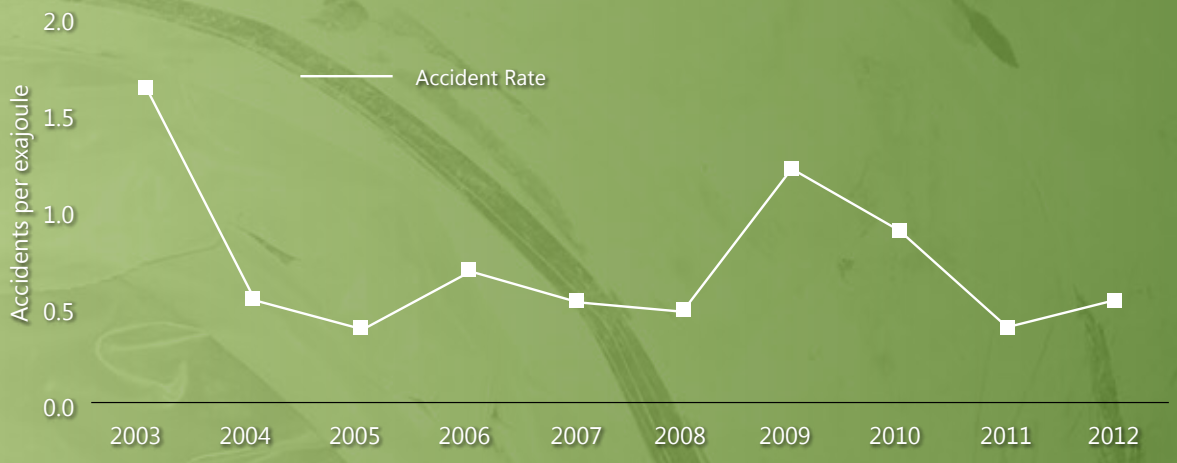
Annual statistics

In 2012, 7 pipeline accidents were reported, up from the 2011 total of 5, but below the 2007-2011 average of 9. According to information provided by the National Energy Board, estimated pipeline activity increased 3% from 2011. The last fatal pipeline accident in the portion of the industry under federal jurisdiction occurred in 1988, and only 1 accident resulting in a serious injury took place in 2012.

In 2012, 173 pipeline incidents were reported, up from 167 in 2011 and the five-year average of 116. In all, 85% of those incidents involved an uncontained or uncontrolled release of small quantities of gas, oil and high-vapour-pressure products. To better understand this recent increase, the TSB carried out a detailed review of the incident data, and has launched consultations with the pipeline industry.

Figure 7: Pipeline occurrences

Figure 8: Pipeline accident rate



Exajoules are estimated for 2011 and 2012 (Source: National Energy Board)

Investigations

In 2012-2013, 3 pipeline investigations were started, and none were completed this year.

Table 4: Pipeline Branch at a glance

	2007–2008	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Investigations started	2	1	3	1	0	3
Investigations completed	2	2	1	3	1	0
Average number of days to complete investigations	490	543	375	432	404	n/a
Recommendations	0	0	0	0	0	0
Safety advisories	0	0	0	2	1	0
Safety information letters	0	1	0	0	0	2

Recommendations and progress

No pipeline safety recommendations were issued in 2012-2013. Because all of the TSB's pipeline recommendations have received the Board's highest rating of Fully Satisfactory, no responses to recommendations were reassessed.

Pipeline highlights

Keeping underground pipelines below the surface

Canada has an extensive network of pipelines that deliver crude oil and natural gas from one end of the country to the other. Usually, most of this network is buried underground, but when a small amount of earth gave way in April 2012, a 30-metre section of pipeline was exposed. It happened near Toronto, Ontario, not far from a residential area and a major waterway. As a precaution, the pipeline, operated by Enbridge Pipelines Inc., was shut down and its internal pressure was reduced.

The day after the exposed pipeline was discovered, Enbridge employees removed the remaining soil and began a detailed assessment to uncover any structural damage. The TSB issued a safety information letter focusing on the requirement for companies to periodically patrol their pipelines. This prompted Enbridge to review its overflight monitoring program and examine slope stability. These initiatives will help ensure underground pipelines remain safely below the surface.

Protecting employee safety

In any industry, employees have the right to work in a safe environment. In the pipeline sector, where there is heightened risk of exposure to flammable goods, extra precaution must be taken.

In June 2012, two Spectra Energy Transmission employees were inspecting some valves at a compressor station near Fort St. John, B.C. One of the valves was leaking sweet natural gas. The escaping gas ignited, resulting in a fire and causing serious burns to both employees.

During our initial assessment, the TSB determined that the employees were not wearing personal gas detectors, which would have alerted them to the leak. As a result, the TSB sent a safety information letter to the National Energy Board, the federal body responsible for regulating the pipeline industry. In addition to detailing the accident, the letter expressed our concern about a lack of proper safety equipment. Although our investigation into this accident is still ongoing, Spectra Energy Transmission has already updated its policy on portable gas detectors—a positive step towards improving the safety of its employees.

Rail

Influencing changes that improve the safety of the Canadian railway system

Rail sector

Annual statistics

A total of 1011 rail accidents were reported to the TSB in 2012. This is similar to the 2011 total of 1022, but a 10% decrease from the 2007–2011 average of 1128. Rail-related fatalities totalled 82 in 2012, up from the 2011 total of 71 and the five-year average of 76.

Six main-track collisions occurred in 2012, compared to 3 in 2011 and the same as the five-year average of 6. In 2012, there were 63 main-track derailments, a decrease of 38% from the 2011 total of 101 and a 41% decrease from the five-year average of 107. Non-main track derailments increased to 499 in 2012 from 484 in 2011, but decreased from the five-year average of 544.

In 2012, crossing accidents increased to 187 from the 2011 total of 170, but decreased from the five-year average of 195. There were 29 crossing-related fatalities, compared to 25 in 2011 and to the five-year average of 24. Trespasser accidents increased by 10% to 74 in 2012, up from 67 in 2011, but down by 6% from the five-year average of 79. With a total of 49 fatalities in 2012, trespasser accidents continued to account for the majority of rail fatalities.

In 2012, 118 rail accidents involved dangerous goods, unchanged from 2011 and below the five-year average of 147. Two of these accidents resulted in a release of product.

In 2012, rail incidents reported to the TSB in accordance with the mandatory reporting requirements totalled 204, the same as in 2011 and comparable to the five-year average of 202. Incidents (120) involving movements exceeding the limits of authority made up the largest proportion of the 204 reportable incidents, while incidents involving a leak of dangerous goods (63) accounted for the second-largest proportion.

Figure 9: Rail occurrences

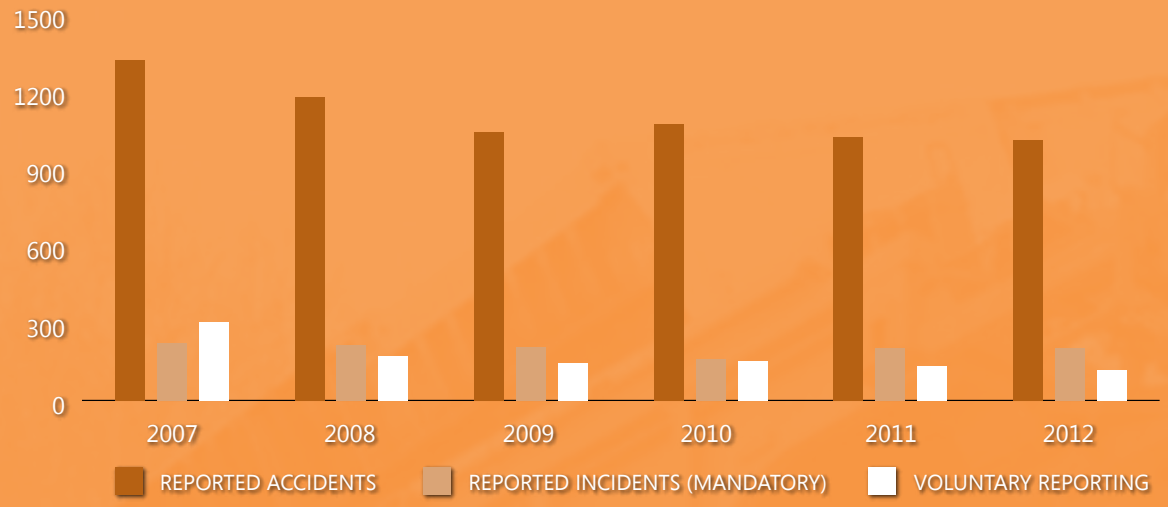
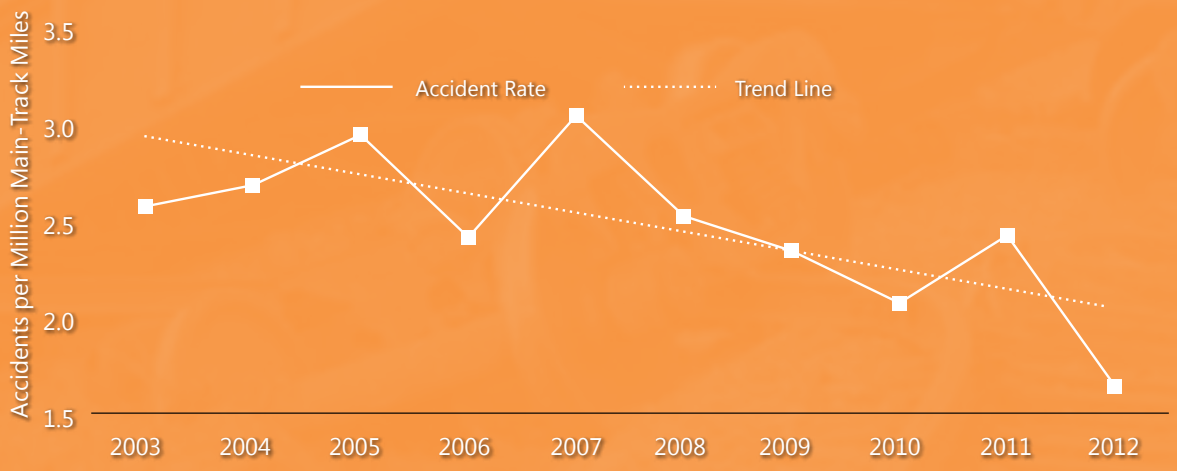


Figure 10: Main-track accident rate



Main-track train-miles are estimated. (Source: Transport Canada.)

Investigations

In 2012-2013, a total of 12 rail investigations were started and 16 were completed. The average time to complete an investigation was 409 days, down from the 2011-2012 average of 488 days and the previous five-year average of 534 days.

Table 5: Rail Branch at a glance

	2007–2008	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Investigations started	13	14	18	14	17	12
Investigations completed	14	22	13	16	19	16
Average number of days to complete investigations	698	540	499	443	488	409
Recommendations	4	2	4	1	0	0
Safety advisories	16	11	8	9	9	4
Safety information letters	13	12	9	8	18	14

Recommendations and progress

No rail safety recommendations were issued in 2012-2013; however, the Board reassessed responses to 13 recommendations issued since 1990. Canada's rail sector also saw positive activity last year, with two recommendations (R00-03 and R10-01) reassessed to meet the Board's highest rating of Fully Satisfactory. Yet, as was the case last year, safety at railway crossings continues to pose significant risks, as recommendations targeting the adoption of the *Grade Crossing Regulations* (R01-05), signage for low ground clearance vehicles (R09-04), vehicle collision defenses in the high speed corridor (R01-05) and emergency contact signage (R09-02) remain unresolved.

Of the 13 active rail recommendations, 4 are Fully Satisfactory, and have been removed from active monitoring. Of the 7 recommendations reassessed as Satisfactory Intent, 6 are unchanged from last year, while 1 (R93-11) was upgraded from Satisfactory in Part. The 2 remaining recommendations (R00-04 and R03-02) stay unchanged.

Rail highlights

Making railway crossings safer

On average, 60% of passenger train-vehicle collisions result in injury or death. With trains and vehicles routinely passing over nearly 15,000 crossings in Canada, the Board is concerned about a lack of safety defences. A recent investigation (R11T0175) into one such occurrence further highlighted the need for improvements. It was in July 2011, and a VIA Rail passenger train was travelling through the town of Glencoe, Ontario, when the crew noticed a pickup truck approaching a crossing ahead. As the train drew closer, it became apparent that the vehicle wasn't slowing down. Despite all efforts to alert the driver, the train simply couldn't stop before the crossing and struck the vehicle. The lone occupant was airlifted to a hospital where he later succumbed to his injuries.

Much like roughly two-thirds of the country's crossings, the one in Glencoe didn't have gates, flashing lights or bells—active defences that help prevent train-vehicle collisions. During our investigation, we issued an advisory letter to TC, alerting them to the dangers at this crossing and others in the Chatham Subdivision. As a result, Operation Lifesaver, an educational partnership initiative, provided several awareness sessions to students at nearby schools about safety at railway crossings.

Concrete measures to address driver behaviour were also taken as a result of our investigation. The Road Authority, for example, assessed the safety of all crossings in the area, and CN submitted a funding application to install better defenses at the Glencoe crossing. More encouraging still, the final round of consultations on new legislation is now complete and, once in place, will help make grade crossing owners more accountable for safety at crossings.

Reducing the risk of derailment

Trains provide Canadians with an efficient way to get from point A to point B, but sometimes conditions align that lead to an accident. This was the case in December 2011 when TSB investigators were called to the scene of a derailment at Montréal's Central Station. Thankfully, none of the passengers aboard the Agence métropolitaine de transport (AMT) commuter train were injured, but deficiencies requiring immediate action were soon uncovered.

Our investigation (R11D0099) concluded that when heavy trains, such as the AMT commuter, operate on lower classes of track, defenses may not be in place to prevent excessive widening of the track, increasing the risk of derailment. Following the accident, Canadian National (CN) increased the number of visual inspections—from once a month to once a week. They also repaired and upgraded four tracks at the Montréal station. TC followed suit, updating the *Track Safety Rules* to require all Class 1 tracks where passenger trains travel to be inspected on a weekly basis.

AMT has also launched several other safety initiatives aimed at addressing the conditions that led to the derailment. Re-profiled wheel treads, for example, have been installed to reduce lateral curve forces by roughly 9%, and new wheel lubricators are expected to reduce them by an additional 7% to 35%. The TSB's hope is that the safety lessons learned here will be applied to even heavier trains, such as those operated by VIA Rail Canada and Amtrak, so that the risk of derailment is further reduced.

Aviation

Pushing for change—and safer operations—for all Canadians

Aviation sector

Annual statistics

Canadian-registered aircraft [5] were involved in 239 reported accidents in 2012, a 4% increase from the 2011 total of 230, but a 5% decrease from the 2007–2011 average of 252 accidents.

Canadian-registered aircraft were involved in 33 fatal occurrences, with 54 fatalities in 2012, compared to 30 fatal occurrences with 62 fatalities in 2011 and the five-year average of 30 fatal occurrences with 58 fatalities. A total of 11 fatal occurrences involved commercial aircraft (6 aeroplanes and 5 helicopters), and 17 of the remaining 22 fatal occurrences involved privately-operated aeroplanes. The number of accidents involving ultralights increased from 17 in 2011 to 36 in 2012. There were 8 fatal accidents in 2012, compared to 3 in 2011.

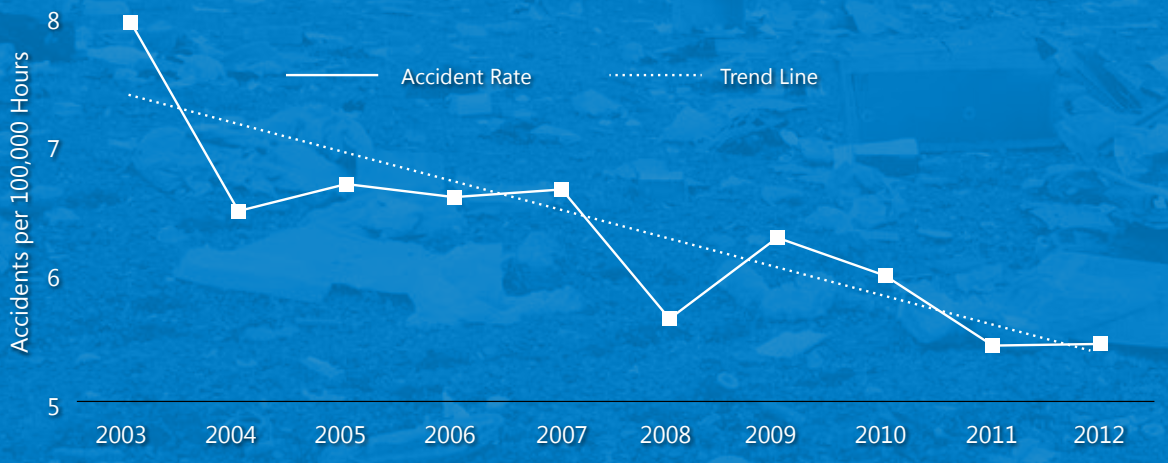
The number of foreign-registered aircraft accidents in Canada for 2012 (16) was up in comparison to the 2011 total (10). There were 2 fatal accidents in 2011 and 1 in 2012.

In 2012, a total of 636 incidents involving Canadian-registered or foreign-registered aircraft were reported, a 6% decrease from the 2011 total of 677 and a 21% decrease from the 2007–2011 average of 808.

[5] Other than ultralights.

Figure 11: Aviation occurrences

Figure 12: Canadian-registered aircraft accident rate



2011 and 2012 hours flown are estimated (Source: Transport Canada)

Investigations

In 2012-2013, a total of 27 air investigations were started and another 26 were completed. This represents a slight decrease from the 28 completed last year. On average, it took 549 days to complete an investigation, up from the 2011-2012 average of 447 days and the previous five-year average of 461 days. This increase was caused by the complexity of certain investigations, as well as delays in staffing vacant positions, which resulted in increased workloads.

Table 6: Aviation Branch at a glance

	2007–2008	2008–2009	2009–2010	2010–2011	2011–2012	2012–2013
Investigations started	49	43	36	40	35	27
Investigations completed	47	46	50	38	28	26
Average number of days to complete investigations	494	431	431	504	447	549
Recommendations	11	1	6	6	0	2
Safety advisories	13	13	9	6	5	5
Safety information letters	9	8	2	3	0	2

Recommendations and progress

In 2012-2013, the Board reassessed responses to 33 recommendations issued since 1990. Two new air safety recommendations were also made this year, which emerged from our investigation into a December 2009 approach and landing accident (A09Q0203).

A major challenge remains in aviation which has seen very limited movement on recommendations. Only 60% of aviation recommendations have received the TSB's highest rating of Fully Satisfactory. Canada has seen a number of aircraft accidents over the past few years that have involved factors relating to these outstanding recommendations. For instance, the TSB has revived 3 dormant recommendations relating to post-impact fires as a result of ongoing accident investigations. In addition, not enough is being done to address a recommendation that calls on TC to require airports with Code 4 runways (1800m) to have a 300m runway end safety area or a means of stopping aircraft that provides an equivalent level of safety.

In fact, only 1 of the 8 Watchlist-related recommendations has become Fully Satisfactory. The 18-year old recommendation called for ground proximity warning systems to be installed on certain classes of aircraft. The other 7 Watchlist-related recommendations on the issues of air safety management systems, landing accidents and runway overruns, risk of collisions on runways and collisions with land and water remain of great concern. The slow pace to reduce risks in the aviation industry is troubling, and the Board continues to press hard for improvement in the uptake of its recommendations.

Recommendation A12-01
As pilots descend towards an airport, they rely on approach charts to determine the approach path to follow. Currently, approach charts only show the minimum obstacle clearance altitude at which aircraft can safely fly. Dip below this altitude, and pilots risk colliding with an obstacle below. For pilots to fly above this height, approach charts must provide the ideal path rather than the minimum obstacle clearance path. The Board therefore recommended that:

The Department of Transport require that the design and depiction of the nonprecision approach charts incorporate the optimum path to be flown.

TC response to Recommendation A12-01

TC agreed with the Board's recommendation, and explained that current regulations supported it. New standards for depicting the optimum path on approach charts are also being developed and, once in place, will bring Canada in line with international rules.

Board assessment of TC's response to Recommendation A12-01

Once the new standards for approach charts are adopted, Recommendation A1201 will be addressed. The Board therefore assessed TC's response as Satisfactory Intent.

Recommendation A12-02

When it comes to landing, the majority of Canadian operators approach runways using the stepping down technique, a series of minimum altitudes, almost as if moving down a set of stairs . Unlike descending along the optimal path using a stabilized constant descent angle (SCDA), the step down technique puts aircraft at risk of an accident. The Board therefore recommended that:

The Department of Transport require the use of the stabilized constant descent angle approach (SCDA) technique in the conduct of non-precision approaches by Canadian operators.

TC response to recommendation A12-02

TC agreed with the Board, explaining that SCDA procedures improve safety in most situations. It did, however, feel that flight crews should be able to decide how best to descend. Although TC doesn't intend to require this technique be used for all non-precision approaches, many operators have already adopted it. As technology becomes more accessible, TC only expects these numbers to grow. New NAV CANADA approach charts and promotional efforts by TC should also lead to increased use of this technique.

Following its initial response, TC also provided a three-pronged action plan. In the short term, TC will address obstacles that prevent the use of SCDA, explain the benefits to its inspectors and include the updated approach charts in the *Aeronautical Information Manual*. In the medium term, TC will propose new legislation requiring training providers to adopt new best practices and will assess how well operators are adhering to new guidelines. In the long term, TC intends to evaluate industry progress, and determine whether additional measures are necessary to reduce approach and landing accidents.

Board's assessment of TC's response to Recommendation A12-02

The Board is pleased that TC not only recognizes the safety benefits of the SCDA approach, but that it is taking steps to promote its use. With plans underway to change the design and depiction of approach charts, TC is hopeful that Canadian operators will voluntarily adopt the SCDA technique.

The proposed measures are encouraging, and will help reduce the risk of approach and landing accidents if fully implemented. The Board therefore considers TC's response to be Satisfactory Intent.

Aviation highlights

Reducing approach and landing accidents

For pilots, approach and landing is one of the most critical phases of flight. It requires heightened concentration and a deep understanding of the surrounding environment and the effects it can have on decision-making. In Canada, accidents occurring during this phase of flight are behind nearly 25% of all aviation fatalities. This was the case on the evening of 9 December 2009, when a Beech A100 crashed on approach in Quebec, fatally injuring both pilots aboard.

The aircraft, operated by Exact Air Inc., was flying from Vald'Or to Chicoutimi/Saint-Honoré. Our investigation (A09Q0203) revealed that the crew descended too early below the published limits, which are commonly used by pilots to avoid obstacles during a stepdown approach. The night of the accident, the aircraft was supposed to stop its descent at 900 feet, and then descend to 860 feet until visual contact was made with the runway. Unfortunately, the aircraft continued its descent and collided with trees long before reaching the airport.

In addition to the two recommendations made this year, our investigation led Exact Air Inc. to begin using the SCDA approach technique, rather than the stepdown approach. The company's training program was updated to include a number of recommendations made by the Flight Safety Foundation, and all pilots will be required to retake it. Further, as part of a new awareness campaign called *Objectif Zéro*, Exact Air Inc. encouraged all of its employees to play a more active role in flight safety through the company's safety management system.

As more operators follow in Exact Air's footsteps and adopt the SCDA approach, the risk of approach and landing accidents will only further decrease.

Aiding search and rescue

When accidents happen, the first priority for search and rescue personnel is always to arrive on scene. Without devices that provide accurate information about an aircraft's whereabouts, efforts to locate the site can quickly be hampered. This was the situation faced by rescue crews in October 2011 when the emergency locator transmitter (ELT) broke away from a Cessna 208B Caravan and failed to emit a signal after crashing in the Northwest Territories.

"The TSB is recognized as a leading authority in aviation accident investigation."

Russ Sabo, Emergency Response and Business Recovery, WestJet

The aircraft, operated by Air Tindi, was on a regularly scheduled flight from Yellowknife to Lutsel K'e under visual flight rules. When it didn't arrive on time, a search was launched, and the aircraft was found 26 nautical miles west of its destination.

Our investigation (A11W0151) into this accident revealed that a loosely fastened hook and loop retention strap caused the ELT to be thrown from its mounting tray during the impact. Because thousands of these parts are used in Canada and abroad, the TSB took immediate action to advise TC and ELT manufacturers of the issue at hand. A month later, the U.S. Federal Aviation Administration issued a special information bulletin expressing concern over the ability of hook and loop style fasteners to restrain ELTs during an impact. The European Aviation Safety Agency also echoed the U.S.'s concern. Shortly after, the manufacturer published instructions on how to inspect fasteners and properly secure an ELT during installation. What's more, a new type of ELT has been developed that now includes an internal antenna. This integrated technology is expected to help reduce the risk of damage during an accident.

The steps taken by industry and government in response to this investigation not only reduce the risk of potential damage to ELTs, but will help ensure search and rescue crews spend more time helping people rather than looking for them.

Appendix A – Reports released in 2012-2013

Appendix A includes an overview of safety action taken. For a comprehensive list, please see the final investigation reports.

Marine

Date / location	Report	Vessel	Type	Event
27 August 2010 Coronation Gulf, NU	M10H0006	Clipper Adventurer	Passenger vessel	Grounding
Safety Action Taken **Fisheries and Oceans Canada** The Canadian Coast Guard will use the mandatory vessel reporting system to proactively provide all vessels with a list of Notices to Shipping that are applicable to Arctic waters. A procedure will also be established to update navigational charts north of 60° when a hazard to navigation is discovered.				
31 March 2011 Port of Montréal, QC	M11C0001	BBC Steinhoeft	Bulk carrier	Grounding
Safety Action Taken **St. Lawrence Seaway Management Corporation (SLSMC)** The SLSMC repaired the lighting below the St. Lambert lock and plans to install a green light near the south shore canal below the lock. The south-side embankment and the Jacques Cartier pillar lighting points are also now operational.				
03 May 2011 Cape Sable, NS	M11M0017	Silver Angel	Fishing vessel	Crew member lost overboard
Safety Action Taken **Charlesville Fisheries Ltd.** The company created an occupational health and safety program, and invited two crew members to report concerns to the safety committee on a monthly basis. Crew members can no longer access the paravane stabilizer by walking on the gunwale and must wear a personal flotation device when working on board the vessel.				
09 May 2011 Johnstone Strait, BC	M11W0063	Neptune II	Fishing vessel	Fire and sinking
Safety Action Taken **TC** TC advised all marine safety inspectors to encourage vessel's crews to follow manufacturer recommended methods for testing open flame heat detector activation.				
21 May 2011 Îles-de-la-Madeleine, QC	M11L0050	Lady Jacqueline	Fishing vessel	Taking on water and abandonment
Safety Action Taken **Vessel owner** The owner had the vessel fitted with an aluminum ladder as a re-boarding device, and three new lifejackets were purchased for the crew.				

Date / location	Report	Vessel	Type	Event
28 June 2011 Fraser River, BC	M11W0091	F.W. Wright	Loaded gravel barge under tow	Striking of a bridge

Safety Action Taken

Mercury Launch & Tug Ltd.

The Board is not aware of any specific safety action taken as a result of this investigation.

Date / location	Report	Vessel	Type	Event
18 November 2011 Nanaimo, BC	M11W0199	Queen of Coquitlam	Ferry	Striking of berth

Safety Action Taken

British Columbia Ferry Services Inc. (BCFS)

BCFS has implemented new standard operating procedures for speed reduction and developed a series of contingency plans and drills.

Date / location	Report	Vessel	Type	Event
15 December 2011 Bécancour, QC	M11L0160	Orsula	Bulk carrier	Grounding

Safety Action Taken

Atlant Bulkers Corp.

The owner instructed all vessels in its fleet to perform an emergency steering drill on Sundays. During the exercise, the master explains how to change from the follow-up to the non-follow-up steering mode and crew members must demonstrate these techniques.

Lloyd's Register

Lloyd's Register strongly recommended that operators ensure all service bulletins are kept up to date and retain a copy on board, in addition to adhering to all maintenance procedures on steering control potentiometers.

Date / location	Report	Vessel	Type	Event
20 December 2011 Nanaimo, BC	M11W0211	Coastal Inspiration	Ferry	Striking of berth

Safety Action Taken

British Columbia Ferry Services Inc. (BCFS)

The power limited indicator light is now connected to the vessel alarm and monitoring system. A schedule of critical failure response drills has been developed by BCFS, and familiarization training now includes verification of responses to critical system failures. A revised emergency-pitch standard operating procedure has been incorporated into Coastal Class vessel manuals.

Date / location	Report	Vessel	Type	Event
Date not applicable, Canada	M09Z0001	n/a	Fishing vessels	Safety Issues Investigation into Fishing Safety in Canada

Safety Action Taken

Safety associations

A number of safety associations have taken concrete action to improve safety. In B.C., Fish SAFE has developed requirements for personal flotation devices, reference guides and education programs. In Quebec, the provincial and federal governments have worked together to create professional certification programs for fishermen, provide a safety manual and create full-time vocational training. The Fisheries Safety Association of Nova Scotia has produced safety manuals, undertaken awareness campaigns and participated in the development of a provincial fishing strategy. In Newfoundland and Labrador, the provincial government has invested $1 million to establish a fishing safety association.

Rail

Date / location	Report	Company	Event
12 February 2011 Fort Fraser, BC	R11V0039	Canadian National	Main track derailment

Safety Action Taken

Canadian National

CN is working with industry and wheel suppliers to find measures to prevent wheel failure, and is testing wheel material that may resist shelling and breaking.

TC

TC is reviewing the industry wayside inspection system and wheel impact load detector criteria, and is working with industry to review the Railway Freight Car Inspection and Safety Rules.

Date / location	Report	Company	Event
08 March 2011 Fernie, BC	R11V0057	Canadian Pacific Railway	Main track derailment

Safety Action Taken

Canadian Pacific Railway (CP)

CP installed new rail and rolled tie plates in the derailment curve, and moved the 30 mph speed sign further east of the derailment curve.

Date / location	Report	Company	Event
06 February 2011 Oakville, ON	R11T0034	VIA Rail Canada Inc.	Damage to rolling stock

Safety Action Taken

VIA Rail Canada Inc.

VIA Rail is installing on-board roller bearing monitoring on corridor head end power baggage cars, modifying the pedestal tie bars, reviewing its bearing requalification specification and emphasized the need to be more vigilant of unusual bearing noise and visual indications of bearing distress.

Date / location	Report	Company	Event
21 October 2011 Alix Junction, AB	R11C0118	Canadian National	Main track derailment

Safety Action Taken

TC

TC revised the Rules Respecting Track Safety, which significantly increased the mandatory requirement for rail flaw testing.

Canadian National (CN)

CN continues to work closely with its rail flaw detection suppliers to improve rail testing.

Date / location	Report	Company	Event
14 July 2011 Pickering, ON	R11T0161	VIA Rail Canada Inc.	Employee fatality

Safety Action Taken

TC

TC is reviewing how federally-regulated railways implement, monitor and conduct training for safety watch protection, and may consider encouraging railways to develop new rules.

Human Resources and Skills Development Canada (HRSDC)

Under the Canada Labour Code, HRSDC directed CN to alter activity that constitutes danger and address three contraventions.

CN

CN took action to address three HRSDC directions.

Date / location	Report	Company	Event
29 July 2011 Glencoe, ON	R11T0175	VIA Rail Canada Inc.	Crossing collision
Safety Action Taken **Operation Lifesaver** Operation Lifesaver provided several education and awareness sessions to students at nearby school about safety at railway crossings. **CN** CN continues to monitor driver awareness at public crossings and submitted a funding application to install active defenses at the Pratt Siding Road crossings. **TC** TC entered into talks with the Road Authority to enhance the level of protection at three crossings and modified regulations to make grade crossing owners more accountable in ensuring the safety at crossings.			
14 July 2011 Waterfall, ON	R11T0162	Canadian National	Main track derailment
Safety Action Taken **CN** CN confirmed that the entire low rail of the curve in question now has a sufficient quantity of spikes, in proper location, to meet or exceed existing standards, and will conduct ongoing inspections. **TC** TC scheduled a follow-up safety inspection of the Bala Subdivision to monitor for risks associated with near-urgent defects.			
29 October 2011 Meharry, MB	R11W0247	VIA Rail Canada Inc.	Movement exceeding limits of authority
Safety Action Taken **VIA Rail Canada Inc.** VIA Rail management provided all operating employees at the Winnipeg terminal with briefings and mentoring to reinforce the Canadian Rail Operating Rules associated with occupancy control system.			
23 June 2011 Edmonton, AB	R11E0063	Canadian National	Main track collision
Safety Action Taken The Board is not aware of any specific safety action taken as a result of this investigation.			
21 January 2012 Fabyan, AB	R12E0008	Canadian National	Main track derailment
Safety Action Taken **CN** CN implemented guidelines for the inspection of curves, turnouts and bridge decks with screw spikes.			
24 September 2011 Pointe-Saint-Charles, QC	R11D0075	Canadian National	Main track derailment
Safety Action Taken The Board is not aware of any specific safety action taken as a result of this investigation.			

Date / location	Report	Company	Event
26 September 2011 Tika, QC	R11Q0050	Quebec North Shore and Labrador Railway	Main track derailment

Safety Action Taken

TC

TC conducted a special inspection and noted that 24 other cars had ill-positioned carrier plates.

Quebec North Shore and Labrador Railway (QNS&L)

QNS&L implemented new car inspection and repair procedures that now include a verification of the carrier-plate positioning.

Date / location	Report	Company	Event
11 December 2011 Dorée, QC	R11Q0056	Quebec North Shore and Labrador Railway	Runaway train

Safety Action Taken

TC

TC conducted a safety inspection that revealed many air brakes were not applying or not remaining applied, and that several hand brakes were not operating well.

Labrador Iron Mines (LIM)

LIM performed single-car tests on all of its cars, and all cars were brought up to Association of American Railways specifications.

QNS&L

QNS&L modified its inspection and brake-test procedures for LIM cars, and now conducts walking brake tests to examine brake cylinders and brake shoes.

Date / location	Report	Company	Event
21 December 2011 Cariboo, BC	R11V0254	Canadian National	Main track derailment

Safety Action Taken

The Board is not aware of any specific safety action taken as a result of this investigation.

Date / location	Report	Company	Event
14 January 2012 Messiter, BC	R12V0008	Canadian National	Collision between a train and track unit

Safety Action Taken

Canadian National

CN reminded its engineering employees of proper track occupancy permit requirements, conducted 18 rail traffic controller efficiency tests, and implemented new technology to electronically issue track occupancy permits.

Date / location	Report	Company	Event
09 December 2011 Montréal, QC	R11D0099	Agence métropolitaine de transport	Non main track derailment

Safety Action Taken

TC

TC inspected the track repairs, and determined the tie conditions met the Track Safety Rules.

Agence métropolitaine de transport (AMT)

AMT launched several initiatives to reduce lateral curving forces, including re-profiling wheel treads and installing truck-mounted wheel lubricators.

Aviation

Date / location	Report	Aircraft	Event
24 July 2010 La Grande-Rivière Airport, QC	A10Q0117	de Havilland DHC-2 Mk. 1	Loss of control and collision with terrain

Safety Action Taken

NAV CANADA

Unit staff received updated procedures and checklists to follow in the event of a crash. Emphasis was placed on calling 911 as soon as possible, as well as performing meteorological observations after an accident.

Date / location	Report	Aircraft	Event
14 January 2011 North Atlantic Ocean	A11F0012	Boeing 767-333	Pitch excursion

Safety Action Taken

Air Canada

Air Canada emphasized that flight crews must adhere to all components of standard operating procedures in order for controlled rest to be safely implemented, explained the benefits of using strategic lateral offset procedures, and highlighted that cabin crews play an important role in controlled rest on the flight deck.

Air Canada Pilots Association (ACPA)

For a period of 60 days, ACPA asked certain pilots to fill out a fatigue form prior to the top of descent to capture their level of alertness and fatigue.

Date / location	Report	Aircraft	Event
09 December 2009 Chicoutimi/Saint-Honoré Airport, QC	A09Q0203	Beech A100	Controlled flight into terrain

Safety Action Taken

Exact Air Inc.

Exact Air Inc. integrated the stabilized constant descent angle technique into its standard operating procedures, installed radio altimeters on its aircraft and reviewed a number of flight and standard operating procedures. In addition to all flying personnel redoing the company's controlled flight into terrain course, a safety awareness campaign was also launched.

NAV CANADA

Templates for SCDA have been submitted, and new constant descent angle standards have been developed.

Date / location	Report	Aircraft	Event
31 July 2010 Lytton, BC	A10P0244	Convair	Collision with terrain

Safety Action Taken

Conair Group Inc.

Conair has modified the glare shield over the instrument panel to improve the pilot's view of the top row of flight instruments. Projects are underway to change the emergency drop selector and modify the load release button on the left-hand control wheel. The pilot training program will also place more emphasis on emergency drop procedures.

B.C. Ministry of Forest Lands and Natural Resource Operations

The Ministry is in the process of clarifying and communicating procedures that allow air tanker operators to conduct ground testing of e-dump systems.

Date / location	Report	Aircraft	Event
04 July 2011 Pukatawagan, MB	A11C0102	Cessna 208B	Runway overrun
Safety Action Taken **Missinippi Airways** Crews have reviewed pilot takeoff techniques, weather conditions and its effect on flight, accelerate/stop parameters and passenger seatbelt/shoulder harness procedures. In addition, parts catalogue print outs of engine controls will be installed in each aircraft, inspection/task binder will be available for quick reference of parts, and a checklist will be used during engine removals and installations.			
03 June 2010 Lac Berté, QC	A10Q0087	Lake Buccaneer LA-4-200	Collision with water
Safety Action Taken The Board is not aware of any specific safety action taken as a result of this investigation.			
09 December 2010 Cap-Chat, QC	A10Q0218	Bell 206B (Helicopter)	Engine failure and hard landing
Safety Action Taken The Board is not aware of any specific safety action taken as a result of this investigation.			
30 June 2011 Buss Lakes, SK	A11C0100	De Havilland DHC-2	Collision with terrain
Safety Action Taken The Board is not aware of any specific safety action taken as a result of this investigation.			
27 May 2011 Butler Lake, ON	A11C0079	Eurocopter AS 350 B-2 (Helicopter)	Engine power loss and forced landing
Safety Action Taken **Federal Aviation Administration (FAA)** The FAA issued an airworthiness directive requiring initial and repetitive replacements of several power turbine governor models. **Honeywell International Inc.** Honeywell issued a service bulletin recommending the replacement of two different bearings at regular intervals and, in conjunction with Timken Aerospace, implemented improved manufacturing processes to ensure diamond particles are removed from the spool bearings before assembly. Honeywell also advised operators about symptoms in case of power turbine governor spool bearing malfunction. **Timken Aerospace** Timken Aerospace ceased shipment of spool bearings PN 2523973 with the lettered suffix N.			
30 November 2011 Fort St. John, BC	A11W0180	Cessna 185E	Controlled flight into terrain
Safety Action Taken **Trek Aerial Survey** Trek Aerial Survey implemented an operational safety management system, began offering biannual aircraft recurrent training, and prohibited flights after sunset in addition to the use of cell phones by pilots during flight.			
23 June 2010 Québec, QC	A10Q0098	Beechcraft A100 King Air	Engine problem and collision with terrain
Safety Action Taken **TC** TC made significant changes to its surveillance program, including updating how surveillance planning is used and introducing tools that provide an improved capacity for monitoring and analyzing risk indicators.			

Date / location	Report	Aircraft	Event
07 February 2011 Puvirnituq, QC	A11Q0028	DHC-8-314 and DHC-8-102	Risk of collision
Safety Action Taken **Air Inuit Ltd.** The company prohibited pilots from using vertical speed mode except when descending.			
28 November 2011 Waterloo, ON	A11O0222	Robinson R22 Beta (Helicopter)	Collision with terrain
Safety Action Taken The Board is not aware of any specific safety action taken as a result of this investigation.			
09 February 2011 Dewdney, BC	A11P0027	Cessna 150G and Cessna 150L	Midair collision
Safety Action Taken **TC** TC issued a safety bulletin regarding the hazards of formation flying and distributed the newest "Take Five" brochure dealing with formation flying at the annual Canadian Owners and Pilots Association convention.			
08 September 2011 Parry Sound, ON	A11O0166	Found FBA-2C2 Bush Hawk-XP	Stall and collision with water
Safety Action Taken **Georgian Bay Airways** The operator included in its operations manual, the correct charts for all of its aircraft, installed a 2000 pound scale at the main base, added "Mags on Both" to the pre-takeoff checklist, and emphasized the importance of complete passenger briefings.			
17 June 2011 Toronto/Buttonville Municipal Airport, ON	A11O0098	Dassault Falcon 10	Runway excursion
Safety Action Taken The Board is not aware of any specific safety action taken as a result of this investigation.			
05 October 2011 Drayton Valley Industrial Airport, AB	A11W0152	Bell 206B (Helicopter)	Continued visual flight into instrument meteorological conditions and collision with terrain
Safety Action Taken **Rotorworks Inc.** Pilots received human factors and decision-making training.			
01 March 2011 Forestville, QC	A11Q0036	Robinson R44 Raven II (Helicopter)	Three helicopters refuelled with wrong fuel type
Safety Action Taken **TC** TC published an article in its Aviation Safety Letter.			

Date / location	Report	Aircraft	Event
01 April 2011 Saskatoon, SK	A11C0047	CASA C-212-CC40	Double engine power loss and forced landing

Safety Action Taken

Fugro Aviation Canada Limited

Fugro grounded its remaining CASA C-212 aircraft immediately following the accident. Before restarting operations, the company revised engine inoperative emergency procedures and modified the aircraft with a remote-controlled cable cutter. Fugro also installed a continuous ignition system for the engines and increased the frequency and scope of some maintenance inspections.

TC

TC inspected Fugro's operational control and maintenance release processes.

Honeywell Aerospace

Honeywell Aerospace has begun revising the component maintenance manual for the torque sensor.

Airbus Military

Airbus Military began revising the CASA C-212 airplane flight manual procedure for engine failure in flight.

Date / location	Report	Aircraft	Event
22 September 2011 Yellowknife, NT	A11W0144	De Havilland DHC-6-300 Twin Otter	Loss of control and collision with building

Safety Action Taken

The Board is not aware of any specific safety action taken as a result of this investigation.

Date / location	Report	Aircraft	Event
13 September 2011 Thunder Bay, ON	A11C0152	Bell 206B (Helicopter)	Freewheel-assembly mal-function during practice autorotation landing

Safety Action Taken

The Board is not aware of any specific safety action taken as a result of this investigation.

Date / location	Report	Aircraft	Event
16 July 2011 St. John's, NL	A11A0035	Boeing 727-281	Runway overrun

Safety Action Taken

Kelowna Flightcraft Air Charters

The company updated its crew resource management training and enhanced the test procedures for flight data recordings.

St. John's International Airport Authority

The runway friction-testing program was expanded.

Date / location	Report	Aircraft	Event
13 March 2011 Toronto, ON	A11O0031	Boeing 737-8Q8	Erroneous air data indications

Safety Action Taken

Sunwing Airlines Inc.

The safety management system reporting process was updated to include a review of the TSB's criteria for reportable accidents and incidents.

Date / location	Report	Aircraft	Event
15 January 2012 Timmins/Victor M. Power Airport, ON	A12O0005	Pilatus PC-12/45	Runway overrun

Safety Action Taken

Air Bravo Corporation

The operator carried out an SMS investigation, and developed several new maintenance and flight operations procedures.

Pilatus Aircraft Ltd.

Pilatus started a feasibility study aimed at improving the current installation without creating new hazards.

Date / location	Report	Aircraft	Event
04 October 2011 Lutsel K'e, NT	A11W0151	Cessna 208B Caravan	Controlled flight into terrain

Safety Action Taken

Air Tindi Ltd.

The company issued new policies for scheduled services operations, improved flight following and timely reporting of departure and arrival times, and began installing cockpit imaging and flight data monitoring devices in its Cessna 208B fleet. Air Tindi also improved operational oversight and introduced random drug and alcohol testing of employees in safety-sensitive positions.

Kannad Aviation

Kannad Aviation developed a new type of ELT that is equipped with an internal antenna, and provided instructions for properly securing the ELT during installation/reinstallation and for inspecting fasteners. The company also described operations for periodic checks required by major aviation authorities.

European Aviation Safety Agency

The Agency wrote a safety information letter that echoed the FAA's concern.

TC

TC will produce an article to highlight the importance of following the manufacturer's installation and retention requirements for ELT installations featuring hook and loop retention systems.

Date / location	Report	Aircraft	Event
17 August 2010 Sept-Îles, QC	A10Q0132	Eurocopter AS 350-BA (Helicopter)	Loss of visual reference with the ground, loss of control, and collision with terrain

Safety Action Taken

Héli-Excel

In addition to working towards equipping the entire fleet with digital flight instruments, Héli Excel increased pilot supervision, created a safety system manager position, and expanded a number of training programs. The company also built an outdoor scale, equipped every aircraft with a portable hanging scale, provided better weight and balance calculation tools, and introduced a surprise audit program.

Hydro-Québec

Hydro-Québec launched an employee awareness program, changed contractual requirements for helicopter providers, increased surveillance of flying experience and training programs, and added a safety component to its helicopter provider evaluations. Hydro-Québec now also requires its providers to have a safety management system.

Appendix B – Glossary

Accident	In general, a transportation occurrence that involves serious personal injury or death, or significant damage to property, in particular to the extent that safe operations are affected (for a more precise definition, see the Transportation Safety Board Regulations)
Incident	In general, a transportation occurrence whose consequences are less serious than those of an accident, or that could potentially have resulted in an accident (for a more precise definition, see the Transportation Safety Board Regulations)
Occurrence	A transportation accident or incident
Recommendation	A formal way to draw attention to systemic safety issues, normally warranting ministerial attention
Safety concern	A formal way to draw attention to an identified unsafe condition for which there is insufficient evidence to validate a systemic safety deficiency but the risks posed by this unsafe condition warrant highlighting
Safety advisory	A less formal means for communicating lesser safety deficiencies to officials within and outside the government
Safety information letter	A letter that communicates safety-related information, often concerning local safety hazards, to government and corporate officials